Effect of Soil and Subhabitat Differentiation on Seedling Establishment and Growth of *Acacia mellifera* Subsp. Detinens in a Semi-Arid Savanna of South Africa

G. N. Smit
University of the Free State, South Africa

M. G. Hagos
University of the Free State, South Africa

The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Effect of soil and subhabitat differentiation on seedling establishment and growth of *Acacia mellifera* subsp . detinens in a semi-arid savanna of South Africa

G .N . Smit , M .G . Hagos
Department of Animal , Wildlife and Grassland Sciences , University of the Free State , P .O . Box 339 , Bloemfontein 9300 , South Africa . E-mail : smitgn .sci@ufs .ac .za

Key words : allelopathic , bush encroachment , germination , growth

Introduction *Acacia mellifera* subsp . detinens is commonly viewed as a problem plant . Total clearing of *A . mellifera* is thus a common practice , but re-encroachment often occurs . The objective of this study was to determine the dynamics of *A . mellifera* seedlings grown in soil collected within three subhabitats : two areas under the canopies of mature *A . mellifera* trees , the first close to the main stem of the plant and the second approximately in the middle of the canopy and the third in open areas between the canopies of the trees .

Materials and methods Soil and seeds of *A . mellifera* were collected near the town of Bray in the North-West Province of South Africa . The soil is sandy and extremely low in organic matter and mineral elements . Thirty plastic pots in a controlled environment were filled with soil and three randomly selected seeds were sown in each pot . The height of the seedlings was measured every five days and after three months all the seedlings were harvested and measurements taken (Table 1) . A Randomized Complete Block Design was implemented and least significant differences (LSD) were calculated from the appropriate standard errors to estimate the significance of the differences between means .

Results Statistically significant ($P<0.05$) differences in mean plant height , stem thickness and leaf dry mass of the seedlings grown in the soil close to the stem area in comparison to the other two subhabitats were observed (Table 1) . In all cases , the growth of the seedlings grown in the soil from the subhabitat close to the stem were more prolific , and this also applied to the other variables that did not differ significantly ($P>0.05$) . The higher soil nutrient status , that occurred in relation to a specific spatial gradient from the stem base of the plants (highest) towards the open uncanopied areas (lowest) (Hagos & Smit , 2005) , is considered to be responsible for these differences .

Table 1 *Mean values of the various pant growth parameters of the* A . mellifera *seedlings grown in soil collected from the three different soil subhabitats . Values with different letters in brackets differed significantly at* $P<0.05$.

Variable	SH1	SH2	SH3	LSD	P	n	CV (%)
Plant height (cm)	10 .7 (a)	8 .7 (b)	9 .3 (ab)	1 .518	<0 .05	30	30 .21
Stem thickness (mm)	1 .859(a)	1 .628 (b)	1 .604 (b)	0 .217	<0 .05	30	24 .72
Number of leaves	14 .0 (a)	12 .0 (a)	13 .0 (a)	2 .434	>0 .05	30	36 .28
Total root length (cm)	700 .0 (a)	562 .0 (a)	530 .0 (a)	174 .1	>0 .05	30	56 .39
Leaf dry mass (g)	15 .4 (a)	10 .9 (b)	11 .2 (b)	4 .0	>0 .05	30	64 .30
Stem dry mass (g)	11 .9 (a)	9 .9 (a)	9 .7 (a)	3 .7	>0 .05	30	68 .12
Root dry mass (g)	16 .4 (a)	12 .2 (a)	12 .2 (a)	4 .6	>0 .05	30	67 .59
Total plant dry mass (g)	43 .7 (a)	33 .0 (a)	33 .1 (a)	11 .7	>0 .05	30	61 .69

SH1=Soil from close to the tree stems , SH2=Soil from the middle of tree canopies , SH3=Soil from open areas .

Conclusions No allelopathic effect that inhibits the growth of seedlings in soil from under the mature *A . mellifera* trees was found . Due to a higher soil nutrient status under the canopies of these trees , the cleared areas previously overspanned by their canopies will provide the most suitable areas for the establishment and growth of new seedlings . The removal of mature plants may thus promote rapid re-encroachment , provided there are enough viable seeds .

Reference

Hagos , M .G . , Smit , G .N . , (2005) . Soil enrichment by A*cacia mellifera* subsp . detinens on nutrient poor sandy soil in a semi-arid southern African savanna . *Journal of Arid Environments* 61 , 47-55 .